



# Endocarditis

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# Contents of Lecture

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  - Mycotic aneurysm
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# Endocarditis: Definition

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- Infective Endocarditis: a microbial infection of the endocardial surface of the heart
  - Common site: *heart valve*, but may occur at septal defect, on chordae tendinae or in the mural endocardium
  - Classification:
    - *acute* or *subacute-chronic* on temporal basis, severity of presentation and progression
    - By organism
    - Native valve or prosthetic valve
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# ENDOCARDITIS



Characteristic pathological lesion: *vegetation*, composed of platelets, fibrin, microorganisms and inflammatory cells.

# Pathogenesis

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- **Altered valve surface**
    - Animal experiments suggest that IE is almost impossible to establish unless the valve surface is damaged
  - **Deposition of platelets and fibrin – nonbacterial thrombotic vegetation (NBTE)**
  - **Bacteraemia** – attaches to platelet-fibrin deposits
    - Covered by more fibrin
    - Protected from neutrophils
    - Division of bacteria
    - Mature vegetation
-

# Pathogenesis

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## ■ Haemodynamic Factors

- Bacterial colonisation more likely to occur around lesions with high degrees of turbulence
    - eg. small VSD, valvular stenosis
  - Large surface areas, low flow and low turbulence are less likely to cause IE
    - eg large VSD,
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# Pathogenesis

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## ■ Bacteraemia

- Transient bacteraemia occurs when a heavily colonised mucosal surface is traumatised
    - Dental extraction
    - Periodontal surgery
    - Tooth brushing
    - Tonsillectomy
    - Operations involving the respiratory, GI or GU tract mucosa
    - Oesophageal dilatation
    - Biliary tract surgery
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# Site of Infection

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- Mitral valve more common than Aortic valve:
    - Vegetation usually on ventricular aspect, all 3 cusps usually affected
    - Perforation or dysfunction of valve
    - Root abscess
  - Mitral:
    - Dysfunction by rupture of chordae tendinae
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# EPIDEMIOLOGY

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- Changing over the past decade due to:
    - Increased longevity
    - New predisposing factors
    - Nosocomial infections
  - In U.S and Western Europe incidence of community – acquired endocarditis is 1.7-6.2 cases per 100,000 person-years.
  - M:F ratio 1.7:1
  - Mean age now 47-69 (30-40 previously)
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# EPIDEMIOLOGY

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- Incidence in IVDA group is estimated at 2000 per 100,000 person-years, even higher if there is known valvular heart disease
  - Increased longevity leads to more degenerative valvular disease, placement of prosthetic valves and increased exposure to nosocomial bacteremia
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# PROSTHETIC VALVES

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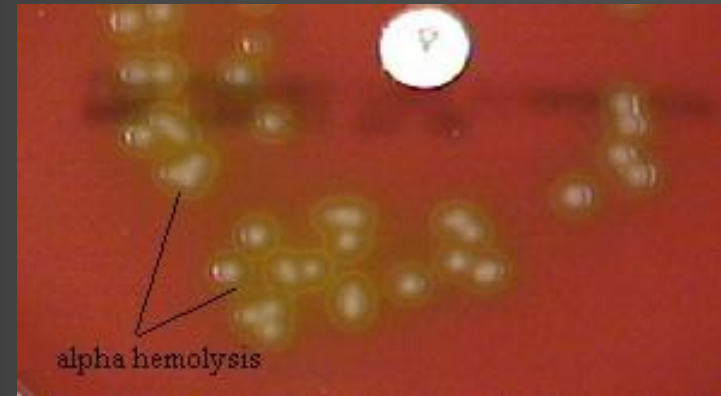
- 7-25% of cases of infective endocarditis
  - The rates of infection are the same at 5 years for both mechanical and bioprostheses, but higher for mechanical in first 3 months
  - Cumulative risk: 3.1% at 12 months and 5.7% at 60 months post surgery
  - Onset:
    - within 2 months of surgery early and usually hospital acquired
    - 12 months post surgery late onset and usually community acquired
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# Nosocomial Infective Endocarditis

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- 7-29% of all cases seen in tertiary referral hospitals
  - At least half linked to intravascular devices
  - Other sources GU and GIT procedures or surgical-wound infection
-

# Aetiological Agents



## 1. Streptococci

- Viridans streptococci/ $\alpha$ -haemolytic streptococci
  - *S. mitis*, *S. sanguis*, *S. oralis*
- *S. bovis*
  - Associated with colonic carcinoma

## 2. Enterococci

- *E. faecalis*, *E. faecium*
- Associated with GU/GI tract procedures
- Approx. 10% of patients with enterococcal bacteraemia develop endocarditis

# Aetiological Agents

## 3. Staphylococci

- Staphylococci have surpassed viridans streptococci as the most common cause of infective endocarditis
  - *S. aureus*
    - Native valves
    - acute endocarditis
  - Coagulase-negative staphylococci
    - Prosthetic valve endocarditis



*Staphylococcus epidermidis*  
on blood agar plate



# Aetiological Agents

## 4. Gram-negative rods

- HACEK group
  - *Haemophilus aphrophilus*, *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, *Kingella kingae*.
  - Fastidious oropharyngeal GNBs
- *E. coli*, *Klebsiella* etc
  - Uncommon
- *Pseudomonas aeruginosa*
  - IVDA
- *Neisseria gonorrhoeae*
  - Rare since introduction of penicillin

# Aetiological Agents

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## 5. Others

- Fungi
    - *Candida* species, *Aspergillus* species
  - Q fever
  - Chlamydia
  - Bartonella
  - Legionella
-



**TABLE 1.** MICROBIOLOGIC FEATURES OF NATIVE-VALVE AND PROSTHETIC-VALVE ENDOCARDITIS.

PATHOGEN	NATIVE-VALVE ENDOCARDITIS				PROSTHETIC-VALVE ENDOCARDITIS		
	NEONATES	2 MO-15 YR OF AGE	16-60 YR OF AGE	>60 YR OF AGE	EARLY (<60 DAYS AFTER PROCEDURE)	INTERMEDIATE (60 DAYS-12 MO AFTER PROCEDURE)	LATE (>12 MO AFTER PROCEDURE)
	approximate percentage of cases						
Streptococcus species	15-20	40-50	45-65	30-45	1	7-10	30-33
<i>Staphylococcus aureus</i>	40-50	22-27	30-40	25-30	20-24	10-15	15-20
Coagulase-negative staphylococci	8-12	4-7	4-8	3-5	30-35	30-35	10-12
Enterococcus species	<1	3-6	5-8	14-17	5-10	10-15	8-12
Gram-negative bacilli	8-12	4-6	4-10	5	10-15	2-4	4-7
Fungi	8-12	1-3	1-3	1-2	5-10	10-15	1
Culture-negative and HACEK organisms*	2-6	0-15	3-10	5	3-7	3-7	3-8
Diphtheroids	<1	<1	<1	<1	5-7	2-5	2-3
Polymicrobial	3-5	<1	1-2	1-3	2-4	4-7	3-7

\*Patients whose blood cultures were rendered negative by prior antibiotic treatment are excluded. HACEK denotes haemophilus species (*Haemophilus parainfluenzae*, *H. aphrophilus*, and *H. paraphrophilus*), *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, and *Kingella kingae*.

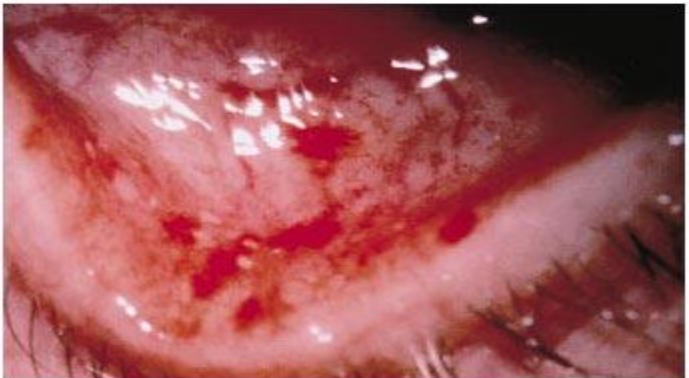
# Clinical Manifestations

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- Fever, most common symptom, sign (but may be absent)
  - Anorexia, weight-loss, malaise, night sweats
  - Heart murmur
  - Petechiae on the skin, conjunctivae, oral mucosa
  - Splenomegaly
  - Right-sided endocarditis is not associated with peripheral emboli/phenomena but pulmonary findings predominate
-



A



B



C



D

## Osler's nodes

Tender, s/c  
nodules

## Janeway lesions

Nontender  
erythematous,  
haemorrhagic,  
or pustular  
lesions often  
on palms or  
soles.

# ENDOCARDITIS



Characteristic pathological lesion: *vegetation*, composed of platelets, fibrin, microorganisms and inflammatory cells.

# Prosthetic valve-Presentation

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- Often indolent illness with low grade fever or acute toxic illness
  - Locally invasive : new murmurs and congestive cardiac failure
  - If prosthetic valve in situ and unexplained fever suspect endocarditis
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# Nosocomial Endocarditis

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- May present acutely without signs of endocarditis
  - Suggested by: Bacteremia persisting for days before treatment or for 72 hours or more after the removal of an infected catheter and initiation of treatment (esp in those with abnormal or prosthetic valves)
  - Risk if prosthetic valve and bacteremia: 11%
  - Risk if prosthetic valve and candidaemia: 16%
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# Investigations

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1. Blood culture
  2. Echo
    - TTE
    - TOE
  3. FBC/ESR/CRP
  4. Rheumatoid Factor
  5. MSU
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# Diagnosis: Duke Criteria

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- In 1994 a group at Duke University standardised criteria for assessing patients with suspected endocarditis
- Include
  - Predisposing Factors
  - Blood culture isolates or persistence of bacteremia
  - Echocardiogram findings with other clinical, laboratory findings



# Duke Criteria

## ■ Definite

- : 2 major criteria
- : 1 major and 3 minor criteria
- : 5 minor criteria
- : pathology/histology findings

## ■ Possible : 1 major and 1 minor criteria

- : 3 minor criteria

## ■ Rejected : firm alternate diagnosis

- : resolution of manifestations of IE with 4 days antimicrobial therapy or less

**TABLE 3. MODIFIED DUKE CRITERIA FOR THE DIAGNOSIS OF INFECTIVE ENDOCARDITIS.\***

CRITERIA	COMMENTS
Major criteria	
Microbiologic	
Typical microorganism isolated from two separate blood cultures: viridans streptococci, <i>Streptococcus bovis</i> , HACEK group, <i>Staphylococcus aureus</i> , or community-acquired enterococcal bacteremia without a primary focus	In patients with possible infective endocarditis, at least two sets of cultures of blood collected by separate venipunctures should be obtained within the first 1 to 2 hours of presentation. Patients with cardiovascular collapse should have three cultures of blood obtained at 5-to-10-minute intervals and thereafter receive empirical antibiotic therapy
or	
Microorganism consistent with infective endocarditis isolated from persistently positive blood cultures	
or	
Single positive blood culture for <i>Coxiella burnetii</i> or phase I IgG antibody titer to <i>C. burnetii</i> >1:800	<i>C. burnetii</i> is not readily cultivated in most clinical microbiology laboratories
Evidence of endocardial involvement	
New valvular regurgitation (increase or change in preexisting murmur not sufficient)	
or	
Positive echocardiogram (transesophageal echocardiogram recommended in patients who have a prosthetic valve, who are rated as having at least possible infective endocarditis by clinical criteria, or who have complicated infective endocarditis)	Three echocardiographic findings qualify as major criteria: a discrete, echogenic, oscillating intracardiac mass located at a site of endocardial injury; a periannular abscess; and a new dehiscence of a prosthetic valve
Minor criteria	
Predisposition to infective endocarditis that includes certain cardiac conditions and injection-drug use	Cardiac abnormalities that are associated with infective endocarditis are classified into three groups: High-risk conditions: previous infective endocarditis, <sup>46,47</sup> aortic-valve disease, rheumatic heart disease, prosthetic heart valve, coarctation of the aorta, and complex cyanotic congenital heart diseases Moderate-risk conditions: mitral-valve prolapse with valvular regurgitation or leaflet thickening, isolated mitral stenosis, tricuspid-valve disease, pulmonary stenosis, and hypertrophic cardiomyopathy Low- or no-risk conditions: secundum atrial septal defect, ischemic heart disease, previous coronary-artery bypass graft surgery, and mitral-valve prolapse with thin leaflets in the absence of regurgitation
Fever	Temperature >38°C (100.4°F)
Vascular phenomena	Petechiae and splinter hemorrhages are excluded
Immunologic phenomena	None of the peripheral lesions are pathognomonic for infective endocarditis
Microbiologic findings	Presence of rheumatoid factor, glomerulonephritis, Osler's nodes, or Roth spots Positive blood cultures that do not meet the major criteria Serologic evidence of active infection; single isolates of coagulase-negative staphylococci and organisms that very rarely cause infective endocarditis are excluded from this category.

\*Criteria are adapted from Li et al.<sup>45</sup> Cases are defined clinically as definite if they fulfill two major criteria, one major criterion plus three minor criteria, or five minor criteria; they are defined as possible if they fulfill one major and one minor criterion, or three minor criteria. HACEK denotes haemophilus species (*Haemophilus parainfluenzae*, *H. aphrophilus*, and *H. paraphrophilus*), *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, and *Kingella kingae*.

# Echocardiography

- Trans Thoracic Echocardiography (TTE)
  - rapid, non-invasive – excellent specificity (98%) but poor sensitivity
  - obesity, chronic obstructive pulmonary disease and chest wall deformities
- Transesophageal Echo (TOE)
  - more invasive, sensitivity up to 95%, useful for prosthetic valves and to evaluate myocardial invasion
  - Negative predictive value of 92%
  - TOE more cost effective in those with *S. aureus* catheter-associated bacteremia and bacteremia/fever and recent IVDA

# Culture Negative Endocarditis

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- 5-7% of patients with endocarditis will have sterile blood cultures
  - 1 Year study from France
    - 44 of 88 cases of CNE, negative cultures were associated with prior administration of antibiotics
  - Fastidious or non-culturable organism
  - Non-infective endocarditis
  
  - Withhold empirical therapy until cultures drawn
-

**TABLE 2. LABORATORY DIAGNOSIS OF COMMON CAUSES OF CULTURE-NEGATIVE ENDOCARDITIS.\***

ORGANISM	APPROACH
Abiotrophia species (previously classified as nutritionally variant streptococci)	Grow in thioglycolate medium of blood culture and as satellite colonies around <i>Staphylococcus aureus</i> on blood agar or on medium supplemented with pyridoxal hydrochloride or L-cysteine
Bartonella species (usually <i>Bartonella henselae</i> or <i>B. quintana</i> )	Serologic tests Lysis-centrifugation system for blood cultures PCR of valve or embolized vegetations <sup>25,28,29</sup> ; special culture techniques available, but organisms are slow-growing and may require a month or more for isolation
<i>Coxiella burnetii</i> (Q fever)	Serologic tests PCR, Giemsa stain, or immunohistologic techniques on operative specimens
HACEK organisms	Blood cultures positive by day 7; occasionally require prolonged incubation and subculturing
Chlamydia species (usually <i>Chlamydia psittaci</i> )	Culture from blood has been described Serologic tests Direct staining of tissue with use of fluorescent monoclonal antibody
<i>Tropheryma whipplei</i>	Histologic examination (silver and PAS stains) of excised heart valve; PCR <sup>26</sup> or culture of vegetation <sup>30</sup>
Legionella species	Subculture from blood cultures, lysis-centrifugation pellet from blood cultures, or operative specimens on BCYE agar; direct detection on heart valves with fluorescent antibody Serologic tests
Brucella species (usually <i>Brucella melitensis</i> or <i>B. abortus</i> )	Serologic tests Prolonged incubation of standard or lysis-centrifugation blood cultures
Fungi	Regular blood cultures often positive for candida species; lysis-centrifugation system with specific fungal medium can increase yield; testing urine for <i>Histoplasma capsulatum</i> antigen or serum for <i>Cryptococcus neoformans</i> polysaccharide capsular antigen can be helpful Accessible lesions (such as emboli) should be cultured and examined histologically for fungi

\*PCR denotes polymerase chain reaction; HACEK organisms haemophilus species (*Haemophilus parainfluenzae*, *H. aphrophilus*, and *H. paraphrophilus*), *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, and *Kingella kingae*; PAS periodic acid-Schiff; and BCYE buffered charcoal yeast extract.

# COMPLICATIONS OF ENDOCARDITIS

## ■ Cardiac :

- congestive cardiac failure-valvular damage, more common with aortic valve endocarditis, infection beyond valve→ CCF, higher mortality, need for surgery, A-V, fascicular or bundle branch block, pericarditis, tamponade or fistulae

## ■ Systemic emboli

- Risk depends on valve (mitral>aortic), size of vegetation, (high risk if >10 mm)
- 20-40% of patients with endocarditis,
- risk decreases once appropriate antimicrobial therapy started.

- Prolonged Fever: usually fever associated with endocarditis resolves in 2-3 days after commencing appropriate antimicrobial therapy with less virulent organisms and 90% by the end of the second week
- Recurrent fever:
  - infection beyond the valve
  - focal metastatic disease
  - drug hypersensitivity
  - nosocomial infection or others e.g. Pulmonary embolus

# Therapy

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## ■ Antimicrobial therapy

- Use a bactericidal regimen
- Use a recommended regimen for the organism isolated
  - E.g. American Heart Association JAMA 1995; 274: 1706-13., British Society for Antimicrobial Chemotherapy
- Repeat blood cultures until blood is demonstrated to be sterile

## ■ Surgery

- Get cardiothoracic teams involved early
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# Therapy

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- Streptococci/Enterococci
    - Determine MIC of Penicillin
    - Penicillin +/- aminoglycoside
    - Ceftriaxone alone
    - Vancomycin +/- aminoglycoside
  - HACEK group
    - Cefotaxime/ceftriaxone
-

# Therapy

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- **Staphylococci**

- **Native valve**

- **Flucloxacillin +/- aminoglycoside**
    - **Vancomycin +/- aminoglycoside/ rifampicin**

- **Prosthetic valve**

- **Flucloxacillin + aminoglycoside + rifampicin**
      - **Vancomycin + aminoglycoside + rifampicin**
-

**TABLE 4.** USUAL ANTIMICROBIAL THERAPY FOR COMMON CAUSES OF INFECTIVE ENDOCARDITIS.\*

PATHOGEN	NATIVE-VALVE ENDOCARDITIS		PROSTHETIC-VALVE ENDOCARDITIS	
	ANTIMICROBIAL THERAPY	COMMENTS	ANTIMICROBIAL THERAPY	COMMENTS
Penicillin-susceptible viridans streptococci, <i>Streptococcus bovis</i> , and other streptococci with MIC of penicillin $\leq 0.1$ $\mu\text{g/ml}$	Penicillin G or ceftriaxone for 4 wk†	A 2-wk regimen of penicillin G (or ceftriaxone) and gentamicin can be used in some cases, <sup>73,74</sup> but it is not recommended for patients with myocardial abscess, extracardiac foci of infection, or prosthetic-valve endocarditis.	Penicillin G for 6 wk and gentamicin for 2 wk†	Shorter duration of treatment with an aminoglycoside (2 wk) is usually appropriate for prosthetic-valve endocarditis due to penicillin-susceptible viridans streptococci, <i>S. bovis</i> , or other streptococci with MIC of penicillin $\leq 0.1$ $\mu\text{g/ml}$ .
Relatively penicillin-resistant streptococci (MIC of penicillin $>0.1$ to $0.5$ $\mu\text{g/ml}$ )	Penicillin G for 4 wk and gentamicin for 2 wk†		Penicillin G for 6 wk and gentamicin for 4 wk†	
Streptococcus species with MIC of penicillin $>0.5$ $\mu\text{g/ml}$ , enterococcus species, or abiotrophia species	Penicillin G (or ampicillin) and gentamicin for 4–6 wk†	6 wk of therapy is recommended for patients with symptoms lasting longer than 3 mo, myocardial abscess, or selected other complications.	Penicillin G (or ampicillin) and gentamicin for 6 wk†	
Methicillin-susceptible staphylococci	Nafcillin or oxacillin for 4–6 wk, with or without addition of gentamicin for the first 3–5 days of therapy‡	In the few patients infected with a penicillin-susceptible staphylococcus, penicillin G may be used instead of nafcillin or oxacillin.	Nafcillin or oxacillin with rifampin for 6 wk and gentamicin for 2 wk†	It may be prudent to delay initiation of rifampin for 1 or 2 days, until therapy with two other effective antistaphylococcal drugs has been initiated.
Methicillin-resistant staphylococci	Vancomycin, with or without addition of gentamicin, for the first 3–5 days of therapy		Vancomycin with rifampin for 6 wk and gentamicin for 2 wk	If the staphylococcus is resistant to gentamicin, an alternative third agent should be chosen on the basis of in vitro susceptibility testing.
Right-sided staphylococcal native-valve endocarditis in selected patients	Nafcillin or oxacillin with gentamicin for 2 wk	This 2-wk regimen has been studied for infections due to an oxacillin- and aminoglycoside-susceptible isolate. Exclusions to short-course therapy include any cardiac or extracardiac complications associated with infective endocarditis, persistence of fever for 7 days or more, and infection with HIV. Patients with vegetations greater than 1–2 cm according to echocardiography should probably be excluded from short-course therapy. <sup>75–77</sup>		
HACEK organisms	Ceftriaxone for 4 wk	Ampicillin and gentamicin for 4 wk is an alternative regimen, but some isolates may produce beta-lactamase, thereby reducing the efficacy of this regimen.	Ceftriaxone for 6 wk	Ampicillin and gentamicin for 6 wk is an alternative regimen, but some isolates may produce beta-lactamase, thereby reducing the efficacy of this regimen.

\*Data are from Bayer et al.,<sup>27</sup> Working Party of the British Society for Antimicrobial Chemotherapy,<sup>71</sup> and Wilson et al.<sup>72</sup> MIC denotes minimal inhibitory concentration; HACEK organisms, haemophilus species (*Haemophilus parainfluenzae*, *H. aphrophilus*, and *H. paraprophylos*), *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, and *Kingella kingae*; and HIV, human immunodeficiency virus.

†Vancomycin therapy is indicated for patients with confirmed immediate hypersensitivity reactions to beta-lactam antibiotics.

‡For patients who have infective endocarditis due to methicillin-susceptible staphylococci and who are allergic to penicillins, a first-generation cephalosporin or vancomycin can be substituted for nafcillin or oxacillin. Cephalosporins should be avoided in patients with confirmed immediate-type hypersensitivity reactions to beta-lactam antibiotics.

# Surgical Therapy

## ■ Indications:

- Congestive cardiac failure
- perivalvular invasive disease
- uncontrolled infection despite maximal antimicrobial therapy
  - *Pseudomonas aeruginosa*, *Brucella* species, *Coxiella burnetti*, *Candida* and fungi
- Presence of prosthetic valve endocarditis unless late infection
- Large vegetation
- Major embolus
- Heart block

# Surgical Therapy

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- The hemodynamic status at the time determines principally operative mortality
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# MORTALITY

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- Depends on ORGANISM
  - Presence of complications
  - Preexisting conditions
  - Development of perivalvular or myocardial abscess
  - Use of combined antimicrobial and surgical therapy
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# MORTALITY

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- *Viridans Streptococci* and *S. bovis* : 4-16%
  - *Enterococci*: 15-25%
  - *S. aureus*: 25-47%
  - *Q fever*: 5-37% (17% in Ireland)
  - *P. aeruginosa*, fungi, *Enterobacteriaceae* > 50%
  - Overall mortality 20-25% and for right-sided endocarditis in IVDA is 10%
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# Prevention

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- Antimicrobial prophylaxis is given to at risk patients when bacteraemia-inducing procedures are performed
  - Look up and follow guidelines
    - American Heart Association. *Circulation* 1997; **96**: 358-366
    - British Society for Antimicrobial Chemotherapy. *Journal of Antimicrobial Chemotherapy* 1993; **31**: 347-438
    - BNF
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# Septic/Suppurative Thrombophlebitis

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- Inflammation of the vein wall often accompanied by thrombosis and bacteraemia
    - Superficial – complication of catheterisation or dermal infection
    - Central (inc. pelvic)
      - Assoc. with catheterisation
      - Abortion, parturition, pelvic surgery
    - Suppurative Intracranial thrombophlebitis
    - Portal vein
-



## ■ Clinical manifestations

- Fever
- Septic pulmonary emboli
- Pelvic: typically 1-2 weeks post-partum
  - High fever, abdominal pain + tenderness

## ■ Treatment

- Appropriate antimicrobial therapy +/- surgery
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# Suppurative Intracranial thrombophlebitis

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- Cavernous sinus
    - From facial infection
    - Ophthalmoplegia
  - Lateral sinus thrombosis
    - Otitis or mastoiditis
  - Superior sagittal sinus
  - Petrosal sinus
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# Lemierre's Syndrome

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- Acute oropharyngeal infection complicated by septic thrombophlebitis of the internal jugular vein and metastatic infection.
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## ADDRESSES AND ORIGINAL ARTICLES

ON CERTAIN SEPTICÆMIAS  
DUE TO ANAEROBIC ORGANISMS \*

BY A. LEMIERRE, M.D.

PROFESSOR OF BACTERIOLOGY IN THE FACULTY OF MEDICINE,  
PARIS; PHYSICIAN TO THE CLAUDE BERNARD HOSPITAL

THE septicæmias dealt with in this address arise from several species of anaerobic organisms which are specifically distinct from one another but which possess the common character of living as saprophytes in the natural cavities of the human body, mouth, pharynx, intestine, and genito-urinary passages; they are fragile, very slightly motile, and grow sparsely on culture media. To this group of organisms belong those Gram-negative and non-spore bearing bacilli which certain bacteriologists group together under the name of "bacteroides"; their rôle in the production of non-traumatic gangrene has been described in France by Veillon, Zuber, Rist, Guillemot, and Hallé. With them must also be placed certain Gram-positive anaerobic micrococci, streptococci, and staphylococci, which have been variously named by the different authors describing them.

These septicæmias arise from inflammatory or suppurative lesions in the tissues or cavities where the above-mentioned anaerobic organisms exist under physiological conditions. Having proliferated in these localities they pass into the blood stream and frequently give rise to septic emboli in distant areas. Such septicæmias tend to arise—

- (1) From inflammatory lesions of the nasopharynx, particularly tonsillar and peritonsillar abscesses.
- (2) From similar lesions of the mouth and jaws.
- (3) In connexion with otitis media or mastoiditis.
- (4) From purulent endometritis following parturition.
- (5) From appendicitis.
- (6) From infections of the urinary passages.

physicians, including Buigold, Fränkel, Claus, and Kissling. The name given by them to the usual causal organism of such septicæmias is *Bacillus symbiophiles*, and they state that it is usually associated with an anaerobic streptococcus. The present incertitude concerning the classification of anaerobic organisms and the diversity of bacteriological tests employed by different observers to identify them make it possible that *B. funduliformis* and *B. symbiophiles* are either identical or else belong to very similar species of bacteria. In any case the description which the German authorities give of the post-anginal septicæmias corresponds feature by feature to what the present writer has observed.

## Clinical Picture

The disease usually affects young adults or adolescents, both sexes being equally attacked. Claus and Kissling have observed that sometimes small epidemics occur, a fact which I can confirm. The most usual initial cause is a tonsillar or peritonsillar abscess, opened too late or to an insufficient degree. At times what appears to be a simple tonsillitis may conceal small foci of suppuration in the depths of the tissues which cannot be demonstrated clinically; an example of this was recently under my observation at the Claude Bernard Hospital in Paris.

Since the original work of E. Fränkel in 1919 German authorities have considered that these septicæmias are the result of a thrombophlebitis of the tonsillar and peritonsillar veins which can spread to the internal jugular vein or even to the facial vein. My own observations agree with this conception.

The first symptom of septicæmia complicating the pharyngeal inflammation is a notable rise of temperature to 101° or 103° F., accompanied by an intense rigor. The rigor usually occurs on the fourth or fifth day after the beginning of the sore-throat, occasionally as late as the eighth, tenth, or even



# Lemierre's syndrome

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“the appearance and repetition, several days after the onset of a sore-throat (and particularly of a tonsillar abscess) of severe pyrexial attacks and an initial rigor, or still more certainly the occurrence of pulmonary infarcts and arthritic manifestations, constitute a syndrome so characteristic that a mistake is almost impossible”

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# Clinical Presentation

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- Usually healthy young adults
  - Oropharyngeal infection
    - Tonsillopharyngitis, mastoiditis, dental infection, surgery, trauma
  - All signs and symptoms may have resolved by presentation
  - Internal jugular vein thrombosis occurs usually 4-8 days after oropharyngeal infection
  - Thrombosis not documented in about 50% of patients
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- Fever, toxic
- Swelling at angle of mandible
- Septic emboli from thrombosed IJ vein
  - Lungs, septic arthritis, visceral abscesses, meningitis etc

## Mortality

- 80% in series described by Lemierre
- 4-12% in more recent series



# Causative agents

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- *F. necrophorum* is most commonly recovered
  - *F. nucleatum*
  - *Peptostreptococcus* species
  - *Bacteroides* species
  - *Haemophilus aphrophilus*
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Gram stain of *Fusobacterium necrophorum*

# Treatment

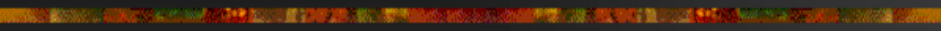
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1. Appropriate antimicrobial therapy
    - Penicillin previously considered drug of choice
    - $\beta$ -lactamase producing isolates now reported
    - Metronidazole,  $\beta$ -lactam-  $\beta$ -lactamase inhibitor combinations, carbapenems, clindamycin
    - Duration of antimicrobial treatment is unknown
  2. Drainage of purulent fluid collections
  3. ?Anticoagulation
  4. ?Internal jugular vein ligation
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# Mycotic aneurysms

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- Term used to describe all extra-cardiac aneurysms of infective aetiology except for syphilitic aortitis
  - Haematogenous seeding of a damaged atherosclerotic vessel
  - Associated with endocarditis
  - Elderly, male>female
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- intracranial
  - Proximal thoracic aorta
  - Other arteries
    - Pre-existing aortic aneurysm
    - Pseudoaneurysm – infection complicating arterial injury

### Aetiology:

- Wide variation

### Treatment:

- Surgery + prolonged antimicrobial therapy
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